

## CRYOCOOLER SERVICE REPORT

**Date of work:** July 6 through July 28, 2004

**Beamline:** 10-ID

**Requestor:** S. Chattopadhyay /Jeff Terry

**Vessel serial no:** AMG0110/52MR

**Pump serial no:** 9-J-95

**Technician(s) performing work:** Dan Burke

### Summary of work:

July 6, 2004: High pressure side buffer had been losing liquid level at a rate of around 1.5% per week since the beginning of the APS operating period and was down to around 78% when checked by D. Burke on 7-1-04. On 7-6-04, liquid level was not apparent. Three attempts to fill the buffer failed. It was noticed that the monochromator was very cold to the touch at the lower half of the vessel and room temperature at the upper half. A frost spot was beginning to form on the lower portion of the mono vessel. The user was asked about the vacuum in the vessel and noticed for the first time that pressures were not much different than atmospheric, indicating a severe liquid nitrogen leak in the mono vessel. The cryocooler was placed on bypass and the supply and return valves to the mono were closed and locked off. Upon doing this, liquid level in the mono was re-established quickly and remained steady throughout the maintenance activity. This verified the presence of a severe leak in the mono vessel.

When the system was inspected early on the morning of July 6, the dewar used to maintain a gas pressure of 20psig on the buffer was found to be empty. It was theorized that the dewar might have gone empty during the weekend and contributed to the loss of liquid in the buffer. It was thought that the blown vacuum seal might have been caused by a high pressure in the cryocooler caused by the failed (empty) dewar. A test was conducted using a cylinder of compressed nitrogen gas as a source to back-feed the GN2 regulator on the dewar. It was found that a high pressure in the buffer would have been relieved through the regulator vent. Thus, there was no evidence of a high pressure having occurred at all in the cryo-system. The blown seal in the mono vessel must have been the result of normal aging due to thermal cycling. The seal was reported to have been installed between 4 and 6 years ago.

July 7, 2004: The mono vessel was allowed to warm overnight. Efforts began to remove the crystal. The indium wrapped helico-flex vacuum seal for nitrogen system was found in a catastrophically failed condition. Evidence was present of the seal having blown out. Seal material was found on the crystal itself.

- July 8-9, 2004: Nitrogen piping internal to the mono vessel was helium leak checked by the ASD Vacuum Group. A leak was found at one of the two conflat flanges at the point where tubing to the crystal is normally connected. The leak was repaired by the Vacuum Group.
- July 27, 2004: The 16mm nitrogen vent line for the low pressure side of the vessel was replaced with a 25mm line. This resulted in a much quieter vent during filling. With the smaller line, the vent made a very loud whistling noise.
- July 28, 2004: The nitrogen supply and return lines were evacuated and then purged with dry nitrogen gas by connecting a temporary line from the nitrogen liquid supply line. The line was cooled through the supply line vent connection until liquid was exiting the vent. The vent was then closed and the high pressure side was cooled/filled normally by the intended means. The fill was routine. The supply and return valves were gradually opened and the bypass valve gradually shut until the mono was completely on line. The pump was started shortly after the supply and return valves were cracked open. This process was relatively brief (approximately 1.5 hours) and uneventful since the vessel had been cool for the weeks preceding this cooldown.
- July 29, 2004: High pressure side level was steady, indicating normal operation and no nitrogen leaks. Buffer level was 83.2%. The bayonet fittings on the supply and return connections were evacuated to eliminate frost spots that were beginning to form.
- July 30, 2004: High pressure side buffer at 82.8%.

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